

Claims

- 5 1. A handover method for a wireless mobile ad-hoc network (2300, 2400, 2500, 2600, and 2700) comprising a number of interconnected mobile nodes (MN, M1, M2, M3, M4, EN1, and EN2), wherein the connectivity of these nodes is time-varying, said handover method being characterized by the following steps:
- proactively probing (S1) QoS resources of each potential routing path between a mobile
10 node (MN) and its correspondent node (CN),
 - pre-allocating (S2) QoS resources along potential routing paths in advance before the handover of a data flow to be transmitted from the mobile node (MN) to its correspondent node (CN) via a selected routing path is initiated,
 - redirecting (S3a) the data flow to the routing path with the best available QoS
15 capabilities and, in case of sufficient QoS capabilities, reserving (S3b) QoS resources for the handled data flow to be transmitted.
2. A handover method according to claim 1, characterized by the step of
- 20 informing (S5) running applications about an upcoming handover event.
3. A handover method according to anyone of the preceding claims, characterized by the step of
- announcing (S6) QoS parameters that can be expected after a handover procedure is
25 finished.
4. A handover method according to anyone of the preceding claims, characterized by the step of
- pro-actively propagating (S7) address-mapping information in the mobile ad-hoc network.
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5. A handover method according to anyone of the claims 1 to 4, characterized in that

soft reservation (SR) requests are applied to reserve, update and monitor QoS parameters along a specific routing path between the mobile node (MN) and the correspondent node (CN) of said mobile node (MN).

5 6. A handover method according to anyone of the claims 1 to 4, characterized in that hard reservation (HR) requests are applied to reserve, change or remove predefined QoS parameters on a specific routing path between the mobile node (MN) and the correspondent node (CN) of said mobile node (MN).

10 7. A handover method according to anyone of the claims 1 to 6, characterized by the step of releasing (S8) reserved resources on other probed routing paths than the respectively selected routing path.

15 8. A handover method according to anyone of the claims 1 to 7, wherein a mobile node (MN) moving out of its covering range communicates with a correspondent node (CN) connected to the network via a number of intermediate network nodes (M1, M2, M3, M4, EN1, EN2, AR1, AR2, R1, and R2) forwarding the data flow to
20 be transmitted between said mobile node (MN) and its correspondent node (CN), characterized in that the mobile node (MN) performs the following steps:

- pre-selecting (S9) nodes from a number of potential handover candidate nodes (M1, M2, M3, and M4) indicating a stable signal strength in the environment of the mobile node (MN) dependent on the received signal power of RF signals received via these handover
25 candidate nodes (M1, M2, M3, and M4),
- sending (S10) a handover initiation message to the correspondent node (CN) to initiate a handover from the mobile node (MN) to one of said handover candidate nodes (M1, M2, M3, and M4),
- selecting (S11) the handover candidate node (M2) which offers the best available QoS
30 metrics on the routing path from the mobile node (MN) to the correspondent node (CN) based on the information contained in a handover QoS metrics collection message received from the respective handover candidate nodes (M1, M2, M3, and M4), and

- hop-by-hop sending (S12) a „Handover Confirmation Message,, with an embedded bandwidth reservation request piggybacked within the traffic from the mobile node (MN) via the respectively selected handover candidate node (M2) to the correspondent node (CN).

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9. A handover method according to claim 8,
characterized in that the correspondent node (CN) performs the following steps:

- sending (S13) a handover QoS metrics probing message hop-by-hop to each handover candidate node (M1, M2, M3, and M4) and
- 10 – performing (S14) a QoS probing procedure for analyzing the QoS metrics of each potential handover candidate node (M1, M2, M3, and M4) as well as a resource pre-allocation along potential routing paths between the mobile node (MN) and its correspondent node (CN).

15 10. A handover method according to claim 9,
characterized in that each handover candidate node (M1, M2, M3, and M4) performs the following steps:

- executing (S15) a QoS metrics collection procedure and
- sending (S16) a handover QoS metrics collection message as a reply message to the
- 20 handover QoS metrics probing message received from the correspondent node (CN) to the mobile node (MN) to inform the mobile node (MN) of the QoS capability of each candidate node (M1, M2, M3, and M4).

11. A handover method according to anyone of the claims 1 to 7,

25 wherein

- a mobile node (MN) communicates with its correspondent node (CN) connected to the dynamic mobile ad-hoc network via a number of intermediate network nodes (M1, M2, M3, M4, EN1, EN2, AR1, AR2, R1, and R2) forwarding the data flow to be transmitted between said mobile node (MN) and the correspondent node (CN) and
- 30 – at least one of the intermediate network nodes (M1) is moving out of its covering range,
characterized in that

the respective intermediate node (M1) which moves out of its covering range performs the following steps:

- pre-selecting (S17) nodes from a number of potential handover candidate nodes (M2, M3, and M4) indicating a stable signal strength in the environment of the moving intermediate node (M1) dependent on the received signal power of RF signals received via these handover candidate nodes (M2, M3, and M4) and
- sending (S18) a „Handover Initiation Message,, to its one-hop neighbor node (EN1) on the routing path towards the correspondent node (CN) to initiate a handover from the intermediate node (M1) to one of said handover candidate nodes (M2, M3, or M4),

12. A handover method according to claim 11,
characterized in that

the one-hop neighbor node (EN1) of the moving intermediate network node (M1) on the routing path from the mobile node (MN) towards its correspondent node (CN) performs the following steps:

- sending (S19) a „Handover QoS Metrics Probing Message,, hop-by-hop to each handover candidate node (M2, M3, and M4) to probe the QoS metrics on the routing path towards these nodes (M2, M3, and M4) and
- performing (S20) a QoS probing procedure for analyzing the QoS metrics of each potential handover candidate node (M2, M3, and M4) as well as a resource pre-allocation along potential routing paths between the mobile node (MN) and its correspondent node (CN) via said one-hop neighbor node (EN1).

13. A handover method according to claim 12,
characterized in that

each handover candidate node (M2, M3, M4) performs the following steps:

- executing (S21) a QoS metrics collection procedure and
- sending (S22) a „Handover QoS Metrics Collection Message,, as a reply message to the „Handover QoS Metrics Probing Message,, received from the one-hop neighbor node (EN1) of the moving intermediate network node (M1) on the routing path from the mobile node (MN) towards its correspondent node (CN) to the opposite one-hop neighbor node (EN2) of the moving intermediate network node (M1) on the routing path

from the mobile node (MN) towards its correspondent node (CN) to inform this node (EN2) of the QoS capability of each candidate node (M2, M3, and M4).

14. A handover method according to claim 13,

characterized in that

the opposite one-hop neighbor node (EN2) of the moving intermediate network node (M1) on the routing path from the mobile node (MN) towards its correspondent node (CN) performs the step of selecting (S23) the handover candidate node (M3) which offers the best available QoS metrics on the routing path from the mobile node (MN) to the correspondent node (CN) based on the information contained in a „Handover QoS Metrics Collection Message,, received from the respective handover candidate nodes (M2, M3, M4).

15. A handover method according to claim 14,

characterized in that

the mobile node (MN) performs the step of hop-by-hop sending (S24) a „Handover Confirmation Message,, with an embedded bandwidth reservation request piggybacked within the traffic from the mobile node (MN) to the correspondent node (CN) via the respectively selected handover candidate node (M3).

16. A cellular telecommunication network with QoS-aware handover management functionality providing a handover method according to anyone of the claims 1 to 15.

17. A mobile base station designed for supporting a method according to anyone of the preceding claims.

18. A computer program product, implementing a method according to anyone of the preceding claims when running on a node of a mobile ad-hoc network.